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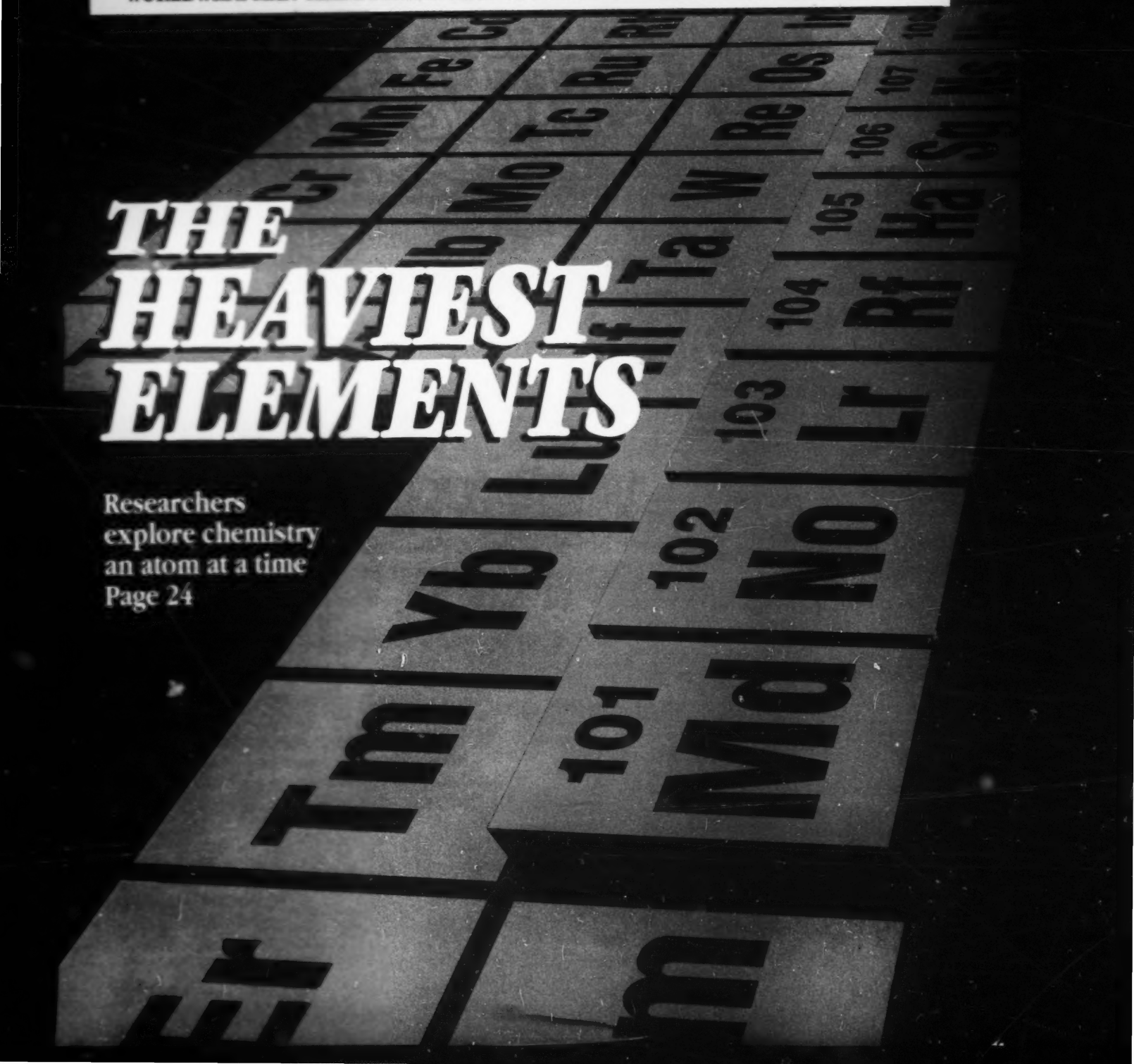
CHEMICAL & ENGINEERING NEWS

C&EN

MAY 2, 1994

WORLDWIDE MAN-MADE FIBERS OUTPUT GREW MODESTLY IN 1993 PAGE 10



THE HEAVIEST ELEMENTS

Researchers explore chemistry an atom at a time Page 24

CHEMICAL & ENGINEERING NEWS

C&EN

MAY 2, 1994

NEWS OF THE WEEK

■ ACS-sponsored permanent exhibit, "Science in American Life," opens at the Smithsonian in Washington, D.C., accompanied by press briefing, symposia, other events. **Page 4**

■ First-quarter earnings of U.S. chemical firms released so far continued increases begun in last year's second quarter. **Page 5**

■ The first oriented growth of molecular sieve (zeolite) crystals on surfaces has been achieved by Purdue University researchers, possibly opening up new catalytic uses. **Page 6**

■ Administration unveils legislation to reform U.S. pesticide laws, particularly as they affect food safety; provisions draw criticism from both industry and public interest groups. **Page 6**

■ DuPont agrees to pay $214 million to settle 220 lawsuits by growers claiming damage to their crops from Benlate fungicide; company says move is not an admission of liability but a way to cut court costs. **Page 7**

■ A number of chemists and chemical engineers are among new members and foreign associates elected to the National Academy of Sciences. **Page 7**

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BUSINESS

Worldwide production of man-made fibers grew 2% last year despite declines in Europe and Japan—up enough to cause fiber makers to be optimistic for 1994. **Page 10**

U.K. chemical capital spending is leveling off following two years of steep decline, but will head down again after next year, according to the Chemical Industries Association. **Page 12**

Business Insights: U.S. chemical firms will step up their investment overseas about 6.5% to $6.61 billion this year, the highest since 1990, although this may change by year's end. **Page 13**

GOVERNMENT

Trade agreement signed last month protects government support of industry R&D and alleviates most concerns, particularly the U.S.'s possible loss of control of its own laws. **Page 15**

Government's success in transferring technology to industry was praised in hearings aimed at heading off proposed legislation over pricing of federally supported projects. **Page 16**

SCIENCE/TECHNOLOGY

Preparation of divalent species of carbon, silicon, and germanium is prompting chemists to ask whether studying these stabilized versions will help them better understand the transient, highly reactive molecules they are modeled after. **Page 20**

Catalytic reduction of nitrogen oxides with ethene and propene at temperatures at which automobile catalytic converters operate produces significant amounts of hydrogen cyanide, Swiss researchers report. **Page 22**

EDUCATION

National Research Council's draft education standards draw mixed reactions at a science education forum in Atlanta. **Page 23**

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Official reports of various ACS committees from the spring national meeting in San Diego are highlighted. **Page 37**

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With just a few atoms—that may exist for only seconds—scientists investigate the chemistry of the elements heavier than fermium. **Page 24**

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Chemical & Engineering News
1155—16th St., N.W., Washington, D.C. 20036

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Published by
AMERICAN CHEMICAL SOCIETY
(202) 872-4600; TDD (202) 872-4432
John Kistler Crum, Executive Director
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Subscription Rates 1994: Printed editions: nonmembers U.S. 1 yr. $115, 2 yr. $207; outside U.S. 1 yr. $152, 2 yr. $281. Air freight rates available on request. Rates above do not apply to nonmember subscribers in Japan, who must enter subscription orders with Maruzen Co. Ltd., 3–10 Nihonbashi 2-chome, Chuo-ku, Tokyo 103, Japan. Tel: (03) 272-7211. Single copies: Current $18. Rates for back issues and volumes are available from Microforms & Back Issues Office, ACS, 1155—16th St., N.W., Washington, D.C. 20036. Back and current issues available on microfilm and microfiche. Rates on request from Microform Program, ACS.

Chemical & Engineering News (ISSN 0009-2347) is published weekly except for the last week in December by the American Chemical Society at 1155—16th St., N.W., Washington, D.C. 20036. Second-class postage paid at Washington, D.C., and additional mailing offices. POSTMASTER: Send address changes to C&EN, Member & Subscriber Services, P.O. Box 3337, Columbus, Ohio 43210. ACS assumes no responsibility for the statements and opinions advanced by the contributors to its publications.

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LETTERS

Nobel Laureates and gender

I am in complete agreement with Victor J. Linnenbom's statement (C&EN, March 28, page 3), "Scientific achievement based on individual accomplishment, rather than group entitlement, must continue to be the sole criterion for selection [of Nobel Prizes]." Like Linnenbom, I decry "political correctness" and the assumption that failure of a particular ethnic group or sex to be represented in awards, jobs, or entitlements by its exact percentage in the general population is prima facie evidence of racism or sexism that must be combated by mechanical application of quotas or affirmative action. In my review of "Nobel Laureates in Chemistry 1901–1992" (C&EN, Feb. 14, page 32) my statement, "Nearly three decades have elapsed since the last selection of a female chemistry laureate, a situation that cries for rectification," was intended as a criticism not of the Nobel selection process but of the woeful underrepresentation in chemistry of women, our most undervalued and underutilized "minority" research resource.

Such unusually low representation of women in science, their struggle merely to be allowed to study science and then, as full-fledged researchers, to obtain suitable positions; to juggle their roles as scientists, wives, mothers, and homemakers; to overcome nepotism rules; to have publications accepted and grant proposals funded; to be admitted to professional societies; and to be adequately rewarded with recognition, honors, and awards is not only my opinion, but a well-documented fact and a problem that is finally receiving attention of late. In C&EN alone, it has been the subject of articles [for example, "Programs Seek To Draw More Women into Engineering and Science" (June 14, 1993, page 43) and book reviews, "A Hand Up: Women Mentoring Women in Science" (Dec. 13, 1993, page 49); "Lifting the Veil: The Feminine Face of Science (Dec. 20, 1993, page 40); and, most pertinent to Linnenbom's concern, "Nobel Prize Women in Science: Their Lives, Struggles and Momentous Discoveries" (April 11, page 41)]. Recently, *Science* devoted much of its March 11 issue to the feature "Women in Science 1994: Comparisons Across Cultures."

Also, 1993 Nobel Laureate in Chemistry Michael Smith of the University of British Columbia donated $175,000 of his approximately $525,000 award to Canadian Women in Science & Technology, a group that encourages women to take up careers in science. He hoped that his action would lead others to do likewise, and he stated, "Male scientists have a responsibility to be supportive and be advocates" of women who want to pursue science (*Calgary Herald*, March 29, page B2).

Manfred E. Wolff's statement that "numerous chemists have been honored by the award of the Nobel Prize in Physiology or Medicine (C&EN, April 11, page 2) is indeed correct. However, it is not I who ignored this fact but the editor of "Nobel Laureates in Chemistry 1901–1992," a perfectly understandable exclusion considering the book's title.

George B. Kauffman
Department of Chemistry
California State University, Fresno

I was saddened as I read Victor J. Linnenbom's letter, about the book review by George E. Kauffman. It illustrated again for me why the struggle to turn the diversity of American society into a strength that allows all members of this society to contribute their full potential of skills and knowledge has been such a battle.

Linnenbom jumps to the conclusion that, when Kauffman said rectification, he meant that the way awarding Nobel Prizes

Continued on page 53

Correction

• Jan. 31, page 20: The World Bank is not now funding DDT plants and has never funded such facilities. The bank will continue to fund public health projects in which DDT is used to control vector-borne diseases, specifically malaria.

Letters to the Editor

C&EN encourages readers to contribute to this letters section. However, please keep letters reasonably short—400 words or fewer. Because we receive a heavy volume of letters, persons writing letters are limited, as a general rule, to one letter within any given six-month period.

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Global Output Of Man-Made Fibers Rose Moderately In 1993

■ ***Led by synthetics, production grew 2% despite drop in Europe and Japan; fiber makers optimistic for this year***

Patricia L. Layman, C&EN London

World production of man-made fibers—which includes synthetics and cellulosics—grew in 1993, rising 2% from 1992 levels, to a record level of 20.3 million metric tons, according to the annual production survey by Dutch fibers company Akzo Nobel. The rate of growth has slowed slightly—it was up 3.1% in 1992, for example—but still was up sufficiently to give fiber makers an optimistic picture on a global basis.

The increase in production was solely due to continued strength in synthetic fibers, including polyester, nylon, and acrylics, according to Friedrich W. Fröhlich, board director of Akzo Nobel responsible for its fiber activities. Production of cellulosics—acetate and rayon—remained at the previous year's level, so their share of total world man-made fiber production continued its gentle slide, to 13%.

According to data presented by Akzo Nobel, the three largest man-made fiber-producing countries—Taiwan, South Korea, and China—now account for just under 30% of total production. And other Southeast Asian countries are increasing production as well.

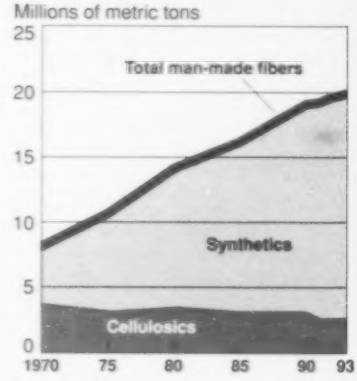
On the other hand, 1993 production in Western Europe declined 5% to 3.3 million metric tons, 16% of the world market. Production of man-made fibers in the U.S. benefited from the economic recovery there, increasing 2% to 3.9 million metric tons and retaining a 19% share of world output. In Japan, which is suffering serious economic difficulties, weak demand led to a drop in man-made fiber production of 5% to 1.8 million metric tons in 1993.

Akzo Nobel is understandably concerned about its own backyard—Western Europe—where the continuing recession resulted in lower demand for textiles and clothing last year. In addition, the region's textile industry suffered from a high level of imports, even though exports increased slightly.

The European fiber industry's major outlets—the textiles and transportation industries—each were hit particularly hard by a combination of recession and structural change. For example, over the course of the year, production volume was down 8% and prices tumbled 14%. "It is very difficult to meet a target productivity average" under those conditions, Fröhlich observes.

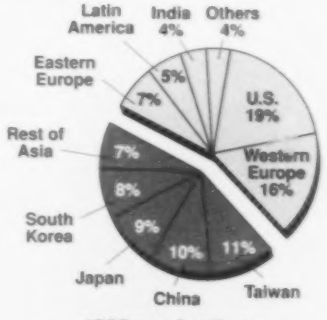
Akzo's results in 1993 in the fibers sector were a good illustration of the difficulties the European fibers industry had last year. Sales for the year were $1.70 billion, down 14% from 1992, although that was in part because of divestments during the year. And from an operating profit of $66 million in 1992, the company slid into an operating loss of $11 million last year. The company shipped 279,000 metric tons of fibers last year, a reduction from the 304,000 shipped in 1992, and capacity utilization was only 81%, versus 85% in 1992.

World output of man-made fibers up 2% in 1993



Source: Akzo Nobel

Almost half of man-made fibers are produced in Asia



1993 production = 20.3 million metric tons

Source: Akzo Nobel

As Fröhlich notes, however, "On the whole, we can say that we did relatively well in a year that was simply disastrous for the man-made fiber industry." And he leaves no doubt about goals for 1994: "This year, we have to write clearly black figures."

Toward that goal, fourth-quarter orders have begun to brighten some prospects. "We see an increase in demand for polyester filament and staple," he says. "We are not completely sure if it is pipeline filling or a major business improvement, but we are optimistic for the rest of 1994. That means an increase in our prices of 5 to 10%—we do not accept new orders without price increases now, in light of the strong demand."

Akzo Nobel is investing heavily in Kunstseidenwerk Elsterberg, the site in Saxony it acquired from the German government privatization agency, the Treuhandanstalt, in September 1993. Says Fröhlich, "This will be the world's

most advanced production plant for textile viscose filament yarns" serving that specialized market.

And although demand for nylon yarns for industrial uses did not reach the level of the previous year in Western Europe, the company is also scrambling to supply nylon yarns for uncoated fabrics for air bags, a market in which it is perhaps the leading producer worldwide. "It is growing so exponentially we have difficulty keeping up," Fröhlich says. By 1998–99, the market will be saturated, he predicts, but until then, things are hopping.

Uncoated fabrics make up nearly all of the European market for air bags and "we [at Akzo] have a dominant proportion—but it will not stay that way." In the U.S., coated nylon fabrics, about 50% more expensive to produce, are still the majority of that sector, but the technology is changing rapidly. And in Japan, fiber producers have licensed Akzo Nobel's technology for air bag production.

The company was running losses in its polyester business last year, as it also has been in its Twaron aramid fibers, subject of a lengthy patent battle with DuPont. That was settled several years ago, but last July, the company was hit by an antidumping suit covering para-aramid fibers coming into the U.S., following a complaint by the sole U.S. producer of para-aramids, DuPont.

In December, the U.S. Department of Commerce fixed a preliminary antidumping duty of 47% on Akzo's fibers. Commerce's final verification on margins is expected this week, followed in June by a ruling from the International Trade Commission on the case. As Akzo Nobel officials point out, the formula for determining a "fair price" for sale in the U.S. included, among other factors, the assumption of a 10% profit—of dubious value when the company has been registering a loss on aramids all along.

"We believe in a fair ruling," says one Akzo Nobel official. "And if so, the conclusion has to be that there is no injury to the U.S. industry, to which we have been exporting only since 1992." He and his colleagues, however, are not sanguine about the outcome: They point out that 90 to 95% of all rulings in cases made by U.S. companies against European competitors go against the Europeans.

The aramid sector, nevertheless, continues to be attractive for Akzo Nobel. Last year, the company decided to boost annual capacity to a total of about 10,500 metric tons, an investment that cost about $80 million. The expansion will be completed by mid-1995, the company says.

It is also continuing development of a new cellulosic filament fiber known tentatively as Newcell, with the commissioning of a pilot plant for the specialty fiber at its German plant in Obernburg, near Frankfurt. Because the fiber is a filament, it will not compete head-on with the Tencel premium viscose staple fibers being produced by Courtaulds, Fröhlich says.

In addition to the ongoing business activities of its fibers division, however, Akzo Nobel executives say their company, and the other fiber producers in Western Europe, must continue to work on modernization to lower production costs, and on restructuring to trim excess capacity and the number of producers.

Partners might help with investments in Europe; they also may ease producers' paths into the growing markets in Southeast Asia. That, for example, is a target area for Akzo Nobel's fibers division, which is of equal importance to the U.S. "All our seven business units [within the fibers division] are exploring opportunities for investments in China, Taiwan, and so on. Maybe we will have some developments there in the next couple of years," Fröhlich says.

Not all the Southeast Asian countries are having a grand time of it, however. According to a new study of the Korean synthetic fibers industry from the Seoul offices of New York City-based securities firm S. G. Warburg, 1993 was a bad year for the synthetic fiber industry, as the South Korean industry "experienced one of its poorest performances in 1993 due to oversupply, decreases in prices, and severe competition."

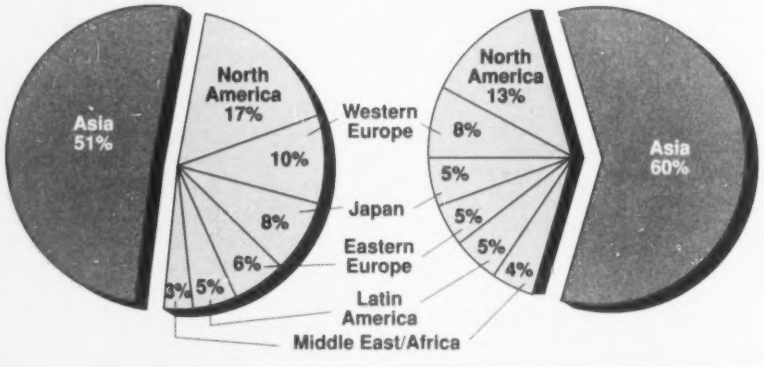
Polyester fiber capacity in South Korea, for example, increased 50% over the past three years, with polyester filament capacity booming 73% and staple fiber growing 23%. Polyester filament prices dropped 20% in 1993, although staple fiber prices remained stable.

Nylon was similarly beleaguered. Nylon filament capacity remained unchanged during the past three years, while staple expanded 24% during the same period. And a new entrant into the market sparked a price war that drove nylon filament prices down more than 25% over the course of last year.

As Warburg analyst Chae Kwang Lee points out in the report, using data from consultants Tecnon (U.K.) Ltd., four Asian companies—not including those from Japan—rank among the world's 10 largest polyester fiber producers: Nan Ya, Taiwan; Yizheng, China; Hualon, Taiwan/Malaysia; and Far East Textiles, Taiwan. "The rapid growth of polyester production in the Asian region is forecast to continue for the next 10 years," he says.

By 2001, Asia will account for 60% of the global market for polyester fiber. As the Warburg report points out, in 1979, the region accounted for only 18% of the total. □

Asia will solidify hold on polyester fiber use by 2001



Source: Tecnon (U.K.) Ltd.

U.K. chemical capital spending to end decline

Following two years of decline of about 10% per year, capital investment in the British chemical industry is leveling off, according to the recently released annual survey of the U.K.'s Chemical Industries Association (CIA).

After falling to about $2.87 billion from a peak of $3.29 billion in 1991, current-price investment this year will hold its own, according to the stated intentions of the companies—roughly two thirds of the group's membership—that took part in the association's survey. However, when adjusted for inflation, the amount intended for capital spending will decline slightly less than 1% from the levels of 1993.

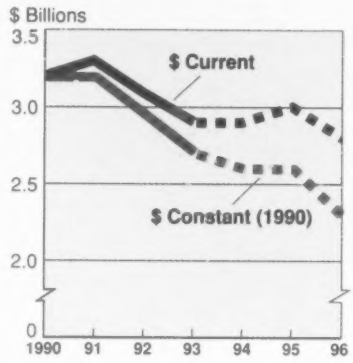
According to Keith Wey, senior economist with CIA, companies have responded to the difficult economic conditions besetting the U.K. over the past several years by reducing their investment plans. Total chemical industry spending levels planned by companies for this year and next, he points out, are 13% below those forecast in the 1993 annual survey.

However, some features have remained the same. For example, investment in R&D facilities continues to account for more than one fifth of total capital investment. And for the second year in a row, more than 70% of new capital spending is designated for specialties and pharmaceuticals. Two years ago, as the industry was wrapping up several major projects, petrochemicals and plastics accounted for nearly 36% of the spending.

"Green" spending—for environmental protection, energy conservation, and health and safety—is expected to hold steady as well at about 27% of the capital spending of CIA members. That was down slightly from the proportion in 1993, Wey acknowledges, but he argues that the trend line is clear: From about 10% of total capital investment in 1990, spending on environmental protection likely will reach 20% by 1996.

On the positive side, Wey notes, this year's survey "continues to highlight the thrust of the industry toward pharmaceuticals and high-value-added products, and toward strong investment in R&D and increasing investment in environmental protection, which as we indicated last year, bring both costs and opportunities."

Spending won't rise when adjusted for inflation



Sources: U.K. government, Chemical Industries Association

The fact that output of chemicals in the U.K. increased 2.7% in 1993 helps explain the leveling off of capital spending intentions for the next three years. "Total investment intentions for 1994 to 1996 add up to about $8.70 billion; in real terms, 10.5% down on capital spending achieved in 1991 to 1993. In view of the usual weakness in the third-year's figure, however, it could be argued that this represents a very modest reduction, particularly when set against some of the cutbacks expected elsewhere in Europe and Japan," he says.

In aggregate, European Union chemical industry new capital spending is forecast to fall about 1.5% this year, following a 15% decline in 1993. The declines last year were paced by Belgium (down 28.5%) and the Netherlands, (down 27%), as both saw completion of major petrochemical projects, and by Germany, down 15%. No growth in capital spending is expected in France or Italy this year, a further drop of 2% is expected in Germany, and only Belgium shows an increase—2.5%.

By comparison, U.S. chemical industry capital spending in 1993 was up 4.5%, points out CIA, although this is expected to drop back slightly, to 3.5% this year. Japan, which measured a 1% fall in chemical industry capital investment in 1993 from 1992, is bracing for a 22.5% decline this year.

CIA officials also found reason for optimism in that intended spending on new products is going up. Innovation, they contend, will be crucial for long-term survival of the industry.

Robin Paul, deputy chairman and managing director of Albright & Wilson, and keynote speaker at the conference at which the spending survey was released, agreed on that point, but first tackled the obvious question of capacity expansion. "It is nearly always more profitable to increase the throughput on an existing plant rather than invest in new capacity," he says. "It requires a major breakthrough in technology to justify the complete replacement of existing capacity, and incremental output from an existing plant almost always costs less than building a new plant from scratch."

He offers a tip for getting the most out of existing facilities. "Our technique has been to appoint small commando teams of boffins [scientists] to observe every minute operation on the plant, round the clock, until they have a complete understanding of all the limiting factors in the plant's output. The team brings a blend of skills from plant operation, engineering design, and chemical research, and [the technique] is a first-class training opportunity for our younger employees."

In the long run, Paul notes, if a company is successful, the business will grow and it will have to invest. Companies deciding to invest in new assets, however, must seek genuine innovation—they can never earn an adequate return on new money by simply copying the last plant to be built or buying off-the-shelf technology available to competitors around the globe.

Patricia Layman

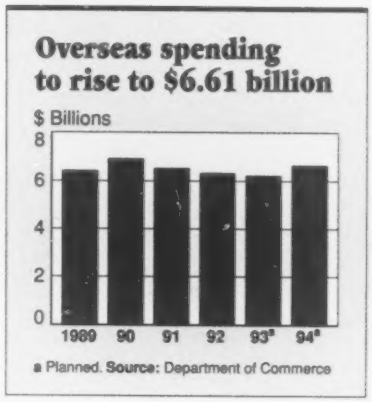
Association members will hold R&D at fifth of their spending

$ Million	1994	1993
Product extension	**$1,063.1**	**$1,005.5**
Existing products	632.1	689.5
New products	431.0	316.0
Replacement/modification to existing facilities	**488.4**	**488.4**
Increased efficiency	**344.8**	**258.6**
R&D	**632.1**	**632.1**
Other	**344.8**	**488.4**
TOTAL	**$2,873.2**	**$2,873.0**

Source: Chemical Industries Association

U.S. chemical capital spending abroad expected to pick up

U.S. chemical companies, betting on a recovery in other major world economies, are planning to increase their spending on new plants and equipment overseas. According to the Commerce Department's annual survey of foreign capital-spending plans of majority-owned affiliates of U.S. companies, chemical and allied products producers plan to raise investment abroad about 6.5% to $6.61 billion in 1994. If this pans out, it will be the highest level of foreign spending since 1990, when capital spending abroad hit $6.90 billion.

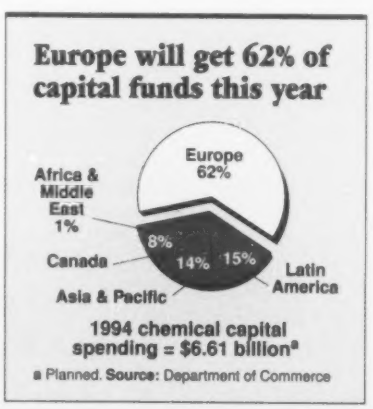


However, it would not be surprising for the increase to change one way or the other, perhaps dramatically, by the time the year is through. For instance, according to the Commerce Department, in a June 1993 survey, producers thought that they would be spending more than $7 billion on chemical plants outside the U.S. in 1993. However, the survey taken at the end of the year shows that spending was more on the level of $6.15 billion.

Spending patterns have not changed much in terms of the areas into which the investment is going. Europe in 1994 will still receive the bulk of capital spending—62%, essentially the same as it did in 1993. Expenditures in Canada, however, will slip to 8.4% from 9.3% last year, and those in the Asia and Pacific grouping, which is usually called the Far East, will decline to 13.7% from 14.5%. Spending in Latin America and other countries in the Western Hemisphere will rise to 15.1% from 13.5%, and Africa and the Middle East will continue to receive about 1%.

Nevertheless, all the regions, except Canada, will show growth this year, according to the survey. Capital spending in Africa and the Middle East will rise 47% from a small base to $66 million. Spending in Latin America will grow about 20% to $998 million, followed by a 7% increase in Europe to $4.09 billion, and a 1% increase in Asia and the Pacific region to $905 million. Capital spending in Canada will decline about 3% to $554 million.

The numbers published by the Commerce Department throw cold water on the idea that the North American Free Trade Agreement (NAFTA), at least for the chemical industry, will cause a flight of investment from the U.S. to Canada or, especially, Mexico. Not only will investment decline in Canada if the current plans are carried out, but investment in Mexico will increase just 5%—less than the rate of increase worldwide. Most of the increase in Latin American investment in 1994 will come, not in Mexico, but in Brazil, up 40% to $392 million, where the Commerce Department says large increases are planned by industrial chemical producers.


Europe will get 62% of capital funds this year
Europe 62%
Africa & Middle East 1%
Canada 8%
Asia & Pacific 14%
Latin America 15%
1994 chemical capital spending = $6.61 billion[a]
a Planned. Source: Department of Commerce

The increase in chemical capital spending by U.S. companies in Mexico is significantly lower than the almost 27% increase planned for all manufacturing industries, which are forecast to spend nearly $2.24 billion on plants and equipment this year.

The modest increase in planned chemical capital spending in Mexico in 1994 is not surprising. Industry sources have argued all along that NAFTA would have only a moderate effect on capital plans of chemical companies. This is simply because the advantage of Mexican production in terms of cheaper labor is counter to the needs of the basic chemical industry, which is not labor intensive but rather heavily capital intensive.

And in a report on major foreign investment projects in Mexico this year, not even Mexico's Ministry of Trade & Industry (Secofi) would credit NAFTA for the rise in foreign investment in that country. The report listed 33 major foreign investment projects planned for the country by U.S. and other foreign companies. Worth more than $6.12 billion, these projects range from basic industries, such as automotive and chemicals, to retailing. Aliza Chelminsky, executive vice president of the Mexican Investment Board, a unit of the ministry, says, "A tide of direct foreign investment continues to flow into Mexico, as this announcement from Secofi demonstrates. The reasons behind the large influx scheduled for this year are basically the same as those that have impelled the huge amounts of foreign investment in Mexico in the past. Specifically, the country has achieved an extremely attractive environment in which to do business and to compete globally."

Chelminsky also points out that when President Carlos Salinas de Gortari took office in 1987, he was committed to doubling the value of direct foreign investment in Mexico from $24 billion, where it stood at that time, to $48 billion at the end of his term in office. However, she notes, today direct foreign investment is $72 billion, far exceeding the original goal.

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